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ABSTRACT

Methods for use by teachers of elementary-school-age children in utilizing outdoor experiences in the study of various subjects are presented in this guide. Learning activities are described in 3 units: (1) language arts, in which students are stimulated to communicate ideas they have about the natural environment and to understand their relationship to it; (2) maps and compasses, in which children learn the skills necessary to finding their way; and (3) soils, in which children learn how necessary is soil to survival. These activities are divided into lead-up activities, outdoor activities, and follow-up activities. Additional information for use by the teacher is also included in this document funded by the Title III Elementary and Secondary Education Act. (PS)

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LEARNING IN THE OUT-OF-DOORS

MOTIVATION

DISCOVERY

INQUIRY

EXPLORATION

INVESTIGATION

RC006339

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UNIT ON LANGUAGE ARTS

Introduction:

The purpose of the activities in this unit is to stimulate students in communicating ideas they have about the environment around them. It is realized that many of the activities can be done without using the natural environment, but it is felt that the direct experiences out-of-doors not only give the students a concrete topic to work with but also help them to become more aware of the natural environment and their relationship to it.

The first activities in this unit center around the development of the use of the five senses, which is important in each of the other areas of language arts presented.

General Objective:

To stimulate an interest in language arts and to develop the ability to communicate through the various means of expression.

Specific Objectives:

1. To have the students realize the importance of utilizing all of their senses when making observations.
2. To provide opportunities for students to use their imaginations through storytelling, writing, and dramatics.
3. To have the students realize that poetry is a means of communicating ideas.
4. To give the students practice in recording and writing about interesting events they have experienced in the out-of-doors.

Concept: All experiences are interpreted by the senses.

Lead-up Activities:

1. Have a discussion about how we learn or know that certain things are so. Ask questions that will direct the responses to a particular sense. For example: On a warm day how can you tell when it is raining out? (Feel it - by getting wet, See it - coming down and puddles forming, Hear it - sound of the rain as it hits different surfaces, and smell it.)

2. Demonstrate that there are different levels of perception. For example: Some people look without really seeing or listen without really hearing. (A game might be played such as recalling the number of different trees on the playground or different sounds heard on the way to school in the morning. Place a number of different items on a table and allow the students to examine them for a few minutes and then have them list as many things as possible that were on the table.)

3. Have the students describe something on the playground such as a tree, flower or other familiar object in as much detail as they can recall. The members of the class might try to guess what the other students are trying to describe.

4. Discuss the ways in which the above descriptions rely on the various senses.

Outdoor Activities:

1. Take the class outside and have them examine the object that they described in Three above. Remind them to use all the different senses that are appropriate for their object and to give as much detail as possible.

2. Let the students stand or sit quietly in different parts of the school ground and record all of the sounds they hear. Then have them identify the sounds and classify them into natural or man made.

3. Have the students stand, turn, walk and run. Ask them to describe how the rushing air feels when doing these different movements.

Follow-up Activities:

1. The students can compare the two descriptions of the same object on the playground to determine how much greater detail they had when they took the time to really examine the object.

2. Have the students describe in various ways, with as much detail as possible, the experiences they have had. (See units on Creative Expression.)

LA-4

Concept: Any outdoor experience may be the basis for tall tales, dramatics and/or storytelling.

Lead-up Activities:

1. Read to the class a tall tale, such as one of the Paul Bunyan stories.
2. Discuss the fact that tales were often created to explain natural phenomena and were originally passed along by word of mouth, to be written down at a later time.
3. Compare a tale to a modern story (My Side of the Mountain). Include their creations, writing styles, languages and the general differences between them.

Outdoor Activity*:

On a class walk, have the students look for possible tall-tale topics. These may be from their own stand point, for example, the explanation of some local natural phenomena or, from the view point of nature, such as an ant explaining the huge growth of a mushroom.

Follow-up Activities:

1. Discuss the scientific explanations for the different phenomena the students found occurring.
2. Have the students write a tall tale about the natural environment and collect some for possible publication in a school journal. Have the students tell their stories to the class as an old story teller would.
3. Divide the class into small groups. Select an idea for a tall tale and begin to tell it. In round-robin style, allow each student in turn to add to the story. Encourage exaggeration and imagination.
4. From the tales developed by the class, allow the students to select and present one as a play. Elaborate preparations are not necessary as the imagination provides a wider playable stage.

* It is realized that each of the areas (tall tales, dramatics, storytelling) can be taught separately, however, the outdoor activity of finding topics would be the same for each.

Concept: Poetry is a means of communication.

Lead-up Activities:

1. Read a poem to the class such as "Fog" by Carl Sandburg or "Birches" by Robert Frost.
2. Explain how certain words and sounds indicate different moods, as the "s" sound often indicates quietness in words such as smooth, soft, sorrow. Such sounds as the "b" and "t" often indicate sharpness - band, brazen, brassy or ting, tough.

   Examples (excerpts)

"The Bells"

...Hear the loud alarm bells, brazen bells.
What a tale of terror, now, their turbelency tells...

-Edgar Allan Poe

"Jazz Fantasia"
...Now a Mississippi steamboat pushes
Up a night river with a hoo-hoo-hoo-oo...

-Carl Sandburg

3. To acquaint the students with the rhythm of words, read several poems with varying meters. Have the class point out that words have different beats and certain combinations of words give a poem movement.

   Examples:

   Words:
   1. Washington, elephant.....(/--dactylic)
   2. about, incline, exploit.....(-/ iambic)
   3. summer, pumpkin, manners.....(/- trochaic)
   4. on the morn, of the day.....(--/anapestic)

   Combinations:

   1. "Half a league, half a league,
      Half a league onward..." Alfred Lord Tennyson
   2. "The parsnip, children, I repeat,
      Is simply an anemic beet." Ogden Nash
   3. "Once upon a midnight dreary, while
      I pondered, weak and weary..." Edgar Allan Poe
   4. "And the sheen of their spears
      was as foam on the sea." Sir Walter Scott

4. Explain that poems can be based on anything including objects, places, events, and people.

   Examples: Objects - "Wild Asters" - Sara Teasdale
   "Trees" - Joyce Kilmer
   "The Wreck" - John Gould Fletcher
   Events - "Charge of the Light Brigade" - Alfred Lord Tennyson
   People - "Annabel Lee" - Edgar Allan Poe
   "John Henry" - American Folk Song
   Places - "Chicago" - Carl Sandburg
   "Home Thoughts, from Abroad" - Robert Browning

Outdoor Activity:

Take the class out and have each student select his own area, separated from each other as far as practical. Have them sit quietly and list as many things as they can sense, using descriptive words and/or short phrases.

Follow-up Activities:

1. To help stimulate thinking ask each child to contribute his description of the objects and feelings, recording the various descriptive words on the board.
2. Using a contemporary French form of 5 line poetry, consisting of 5 words in the first line, decreasing each line by one word, have the students put words together that are pleasing to hear, and that describe their experiences outside.

   Example: 5 Little rocks smaller than raindrops
   4 Rain on light plastic
   3 Small drum beats
   2 Swampy wet
   1 Swish

3. Another form of poetry, perhaps more difficult, is the ancient Japanese Haiku. It is a 17 syllable poem; the first line having 5 syllables; the second line, 7 syllables; and the third, 5 syllables.

   Example: 5 Sunset came in wind
   7 And the sun, a fallen leaf,
   5 Tiptoed into night.

Carole Phillips

4. Have the students select a topic and write a poem using conventional rhyme and rhythm.

5. The students can select an object and write a structured poem. The poem outlines the shape of the object being described. Examples:

```
          A
        CAT
       TAIL
      BENDS
    AWAY
    FROM
     THE
      WIND
       L
       I
        S
        T
         I
         N
          G
          G
           E
           N
            T
            L
            Y
```

```
      STRUMMING
    WITH THE SMOOTH
CLEAR TONES, THE BANJO SINGS MOURNFULLY
    UNDER THE WARM,
      SOFT MOON.
```

LA-8

Concept: Reporting observations accurately is an important part of communications.

Lead-up Activities:

1. Write on the board incorrect or incomplete directions to get from the room to the gym. Let the students indicate what is wrong or missing and why it is important to give accurate directions or information.
2. Using newspaper articles, have the students find the major parts of the first paragraph: who, what, where, when, and how.
3. Discuss with the students why these major factors (the 5 W's and H) constitute a concise means of taking field notes and reporting accurately. Have the students write down the 5 W's and H to take with them into the field.

Outdoor Activities:

While on a hike or class trip have the students look for events to report such as "Ants Protect Home from Human Invaders," "Robin Attacks Worm," "Squirrels Open Branch Office," or "Leaves Turning Brown." Remind the students to take accurate notes in the field.

Follow-up Activities:

1. From the notes taken in the field have each student write a newspaper article.
2. The articles can be printed in a class newspaper.
3. Oral reports can be given by each student from his notes.
4. Discuss the fact that science field notes are taken in a similar manner.

UNIT ON MAP AND COMPASS

Introduction

It is important that we should be able to read a map and know the skills necessary to find our way. It may be that we will never have to use anything more complicated than a road map; however, with the emphasis today on outdoor recreation, it is conceivable that many of the students will have an opportunity to use a map and compass.

General Objective

To develop an understanding of the importance of maps and compasses to travel, property ownership and to the early development of the United States.

Specific Objectives

1. To introduce students to the various types of maps and their uses.
2. To learn to read maps and to utilize map symbols in the drawing of a simple sketch map.
3. To develop the ability to locate objects on a simple scale map in relation to the direction and distances between the actual objects in the field.
4. To develop the skill to make elementary maps to a suitable scale utilizing a plane table, alidade and simple geometric principles.

M-2

Concept: A map is a picture of an area, using symbols to represent places and things.

Lead-up Activities:

1. Discuss what maps are and explain the various kinds of information that can be obtained from them. Include road, topographic, political, airline and relief maps.

2. The derivation of such words as topographic might be explored.

3. Have a discussion on how maps are made, including the use of an aerial photo as the basis for many maps.

4. Define the nature and use of symbols on maps. A symbol may be defined as a graphic representation of a feature that is located in the field. Have the students look at the different maps and compare the symbols used on each. The meaning for each symbol is found in the key or legend.

5. Have the students make up symbols for several features near the school, including trees, fences, bleachers and playground equipment. Several examples of map symbols are shown on page 4.

Outdoor Activity: Sketch Map

Materials: 8 1/2" x 11" unlined paper
pencil or crayons
sketchboard
tape

1. Have the students walk over the school grounds and select an area they want to map (see p. M-3).

2. The students should start with an object in one corner of the area selected and draw its symbol in the appropriate corner on the paper.

3. The symbols for the other features in the area should be placed on the paper by the students in relationship to each other. The distances and direction between features does not have to be determined by accurate procedures but may be estimated. More precise methods of map making will be a part of a later unit.

Follow-up Activities:

1. Compare the maps of the students to determine differences and similarities.

2. Have a discussion on the use of maps and how the maps made by the students can be used.

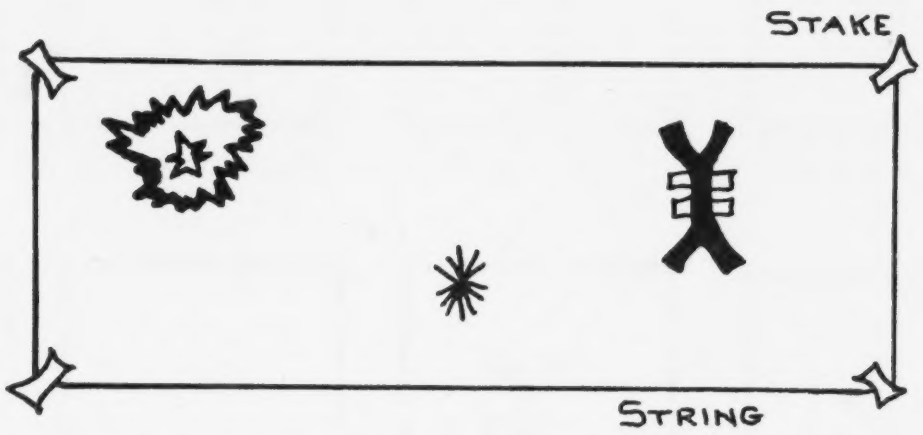
3. A discussion might lead to the understanding for the need to use a scale when making maps as a lead-up to the next concept.

DESIGNATING A PLOT FOR MAPPING

Materials: 4 stakes
string

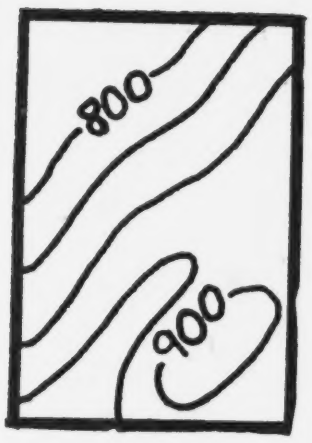
1. Select an area of the school grounds containing several features (trees, fence, flagpole, playground equipment, etc.) that are to be placed on a map.

2. Designate the physical area to be mapped by placing four stakes in the ground to form a square or rectangle. The features to be mapped should be located within the boundaries formed by the four stakes.

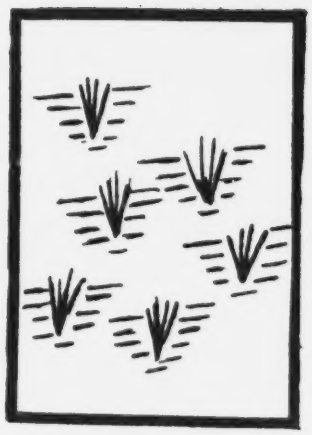


3. Connect the four stakes with a string, placed on the ground, to outline the perimeter of the plot.

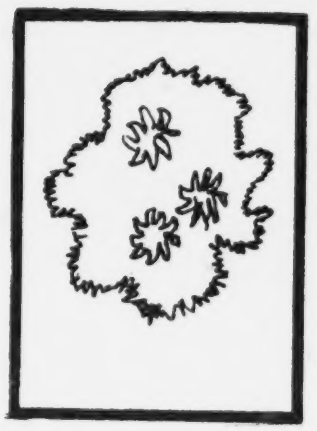
MAP SYMBOLS



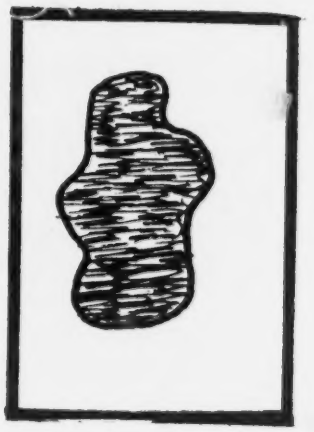
CONTOUR LINES



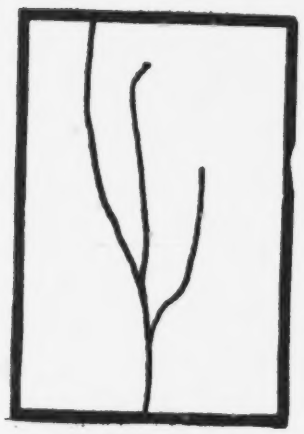
SWAMP



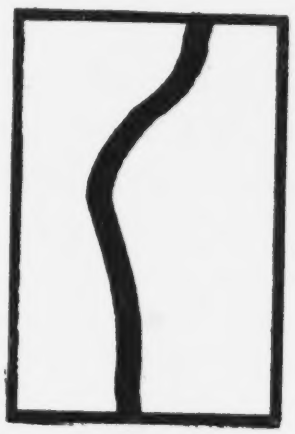
FOREST



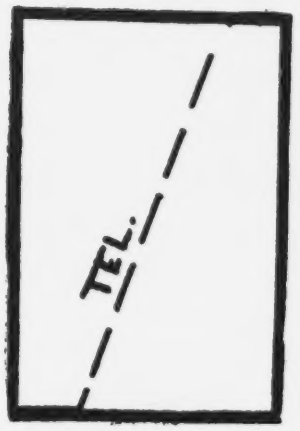
LAKE OR POND



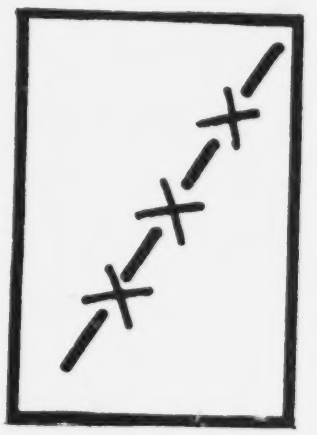
NARROW STREAM



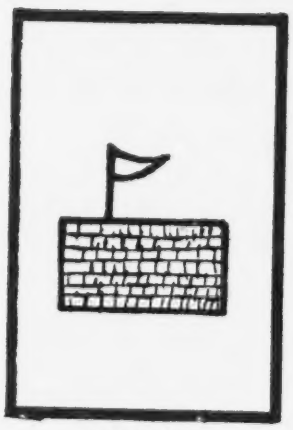
WIDE STREAM



TELEPHONE LINES

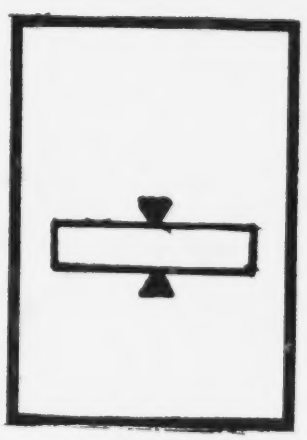


FENCE

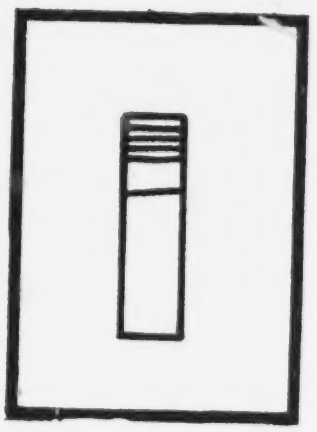


SCHOOL

SWING



SEE-SAW



SLIDE

Concept: A scale tells the actual physical distance between places on a map.

Lead-up Activities:

1. Define scale as the ratio between the distance on the map and the actual distance in the field. Have the students practice drawing to scale an outline of the classroom.
2. Have the students look at different types of maps and interpret the scale used on each.

Outdoor Activity: Maps made to scale

Materials: 8 1/2" x 11" graph paper
pencil
ruler or yardstick

1. Help the students select an area (square or rectangular in shape) with only three or four objects to be mapped in it. They should determine the approximate size of the area so that a scale can be established (see p. M-3).
2. The sides of the area should be placed on the paper first, then the features in the area in the appropriate places. It is best to have the students work in pairs (see p. M-6).

Follow-up Activities:

1. Have the students compare the maps they made to determine the differences and similarities.
2. If adjacent areas are used, all of the maps could be put together to make one large map.
3. Have the students enlarge the map and determine symbols for each of the objects in the field. This enlarged map can be placed on display to help visitors orient themselves to the school area.

M-6

MAKING A SKETCH MAP TO SCALE

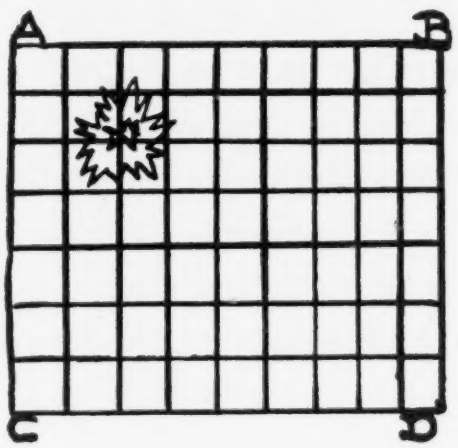
Materials: 8 1/2 x 11" graph paper
pencil
ruler or yard stick, tape measure

1. Measure the sides of the plot to be mapped by direct or indirect methods.

2. Determine a scale that allows the area to be placed on the paper, converting the length of each side to squares.

   2 steps or 3 feet = 1 square of the graph paper
   a side 15 feet long = 5 squares

3. Draw an outline of the plot on the graph paper.



Letter each corner so that it is easier to orient the map with the field.

4. Start at any object in the field and measure the distance, using the same method as above, to the 2 nearest sides of the area.

5. Convert the measured units to scale units. i.e.

   Scale: 2 steps = 1 square of the graph paper
   Center of object to side AB = 4 steps = 2 squares
   Center of object to side AC = 4 steps = 2 squares

6. Place a point on the map representing the object in the appropriate place in relationship to the proper sides.

7. Repeat this procedure until all the features in the field are mapped.

Concept: a. Direction is the geographic relationship of two objects.
b. A compass works because of magnetic attraction.

Lead-up Activities:

1. Discuss different methods of finding direction, such as the use of the North Star, the sun and the magnetic compass.

2. Introduce the students to the cardinal points of direction, N,E,W,S, and locate these points on different types of maps. Relate this to the derivation of the word "news."

3. Familiarize the students with the parts of the compass (see p. M-8) and the physical principles involved in the workings of the compass, such as magnetic force. (The protractor compasses, such as those used by the Girl Scouts and Boy Scouts, are a good basic compass to use.)

4. Have a discussion about degrees and how they relate to the cardinal points. Use the compass to locate these points. (Remember, metal tends to cause deflections and make the compass inaccurate.)

5. Concepts such as deviation, declination and variation are not included but might be covered with high ability groups.

Outdoor Activities:

1. Following a compass course with direction given in terms of degrees.
   a. The students should practice finding a given direction from a degree reading (see p. M-9).

   b. Make up your own compass course or use a compass game, such as the ones by Silva, and have the students use them to practice this skill.

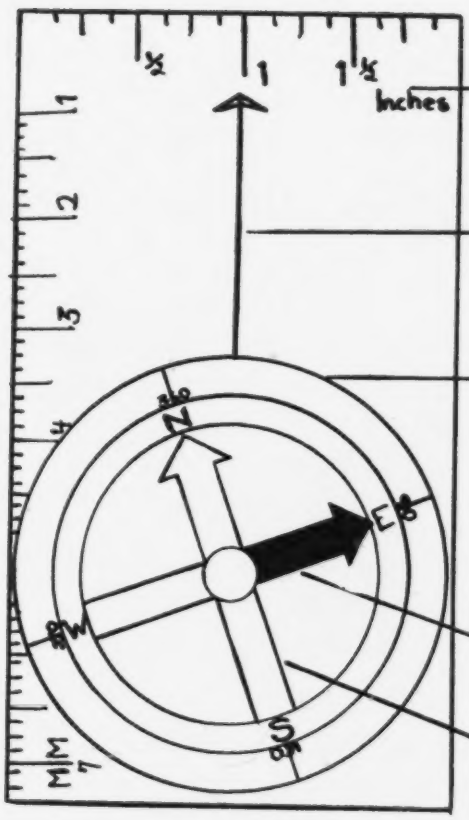
2. Laying a course to determing the degree reading for someone else to follow.
   a. The students should practice finding the bearing of different objects in the field (see p. M-10).

   b. Have the students work in pairs and lay a compass course for another group to follow.

Follow-up Activities:

Discuss the use of the compass with maps. The compass is used to locate North so that the North side of the map will be headed in the correct direction.

PARTS OF THE PROTRACTOR COMPASS



Transparent Base- has direction of travel arrow, scale of inches and millimeters for computing distance.

Direction of Travel Arrow-red arrow on the base, points to the direction you are going.

Compass Housing- "houses" the needle, rotates on the transparent base,graduated in 360°(2° for each division on rim), Read at the intersection of housing and direction of travel arrow.

Magnetic Needle- red and white needle, red end points to Magnetic North.

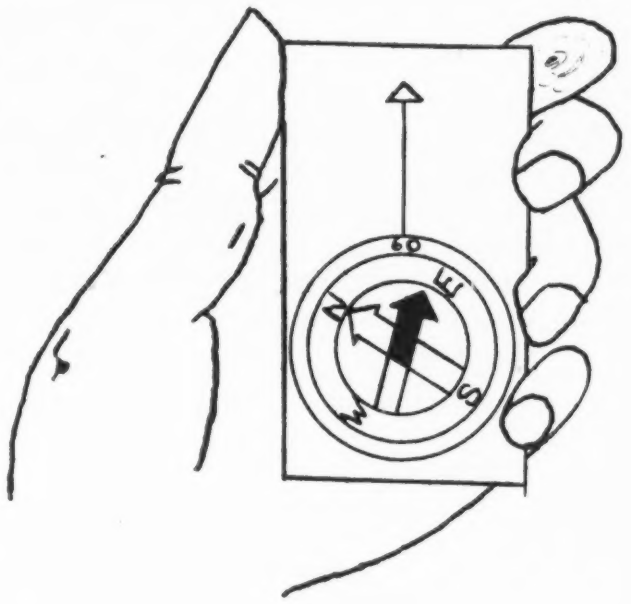
Orienting Arrow- stationary arrow inside housing, indicates 360°(North).

HOLDING THE COMPASS

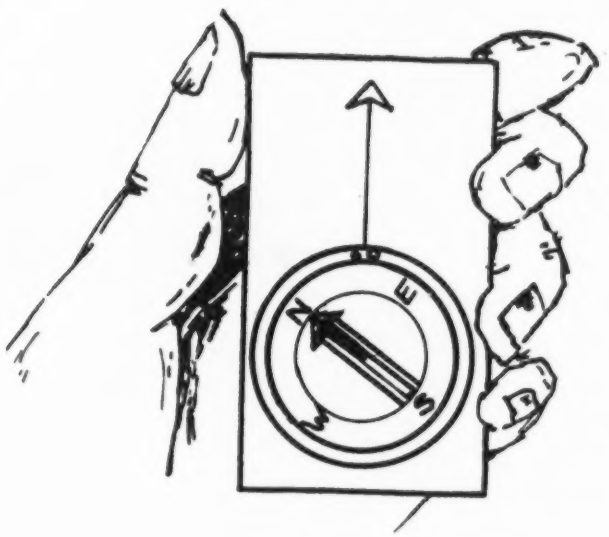
The compass is held in the palm of one hand, at waist height, with the direction of travel arrow pointing perpendicular to the body. The compass should be held level so that the magnetic needle can move freely. The upper fore arm should be held against the body to steady the compass.

FOLLOWING A COMPASS COURSE GIVEN DIRECTIONS OR BEARINGS IN TERMS OF DEGREES

1. Set the compass for direction by turning the housing until the desired azimuth is in line with the direction of travel arrow. The compass in the diagram has been set for an azmiuth of 60 degrees.



2. Hold the compass in a level position in the palm of your hand with the direction of travel arrow pointing the way you are facing.



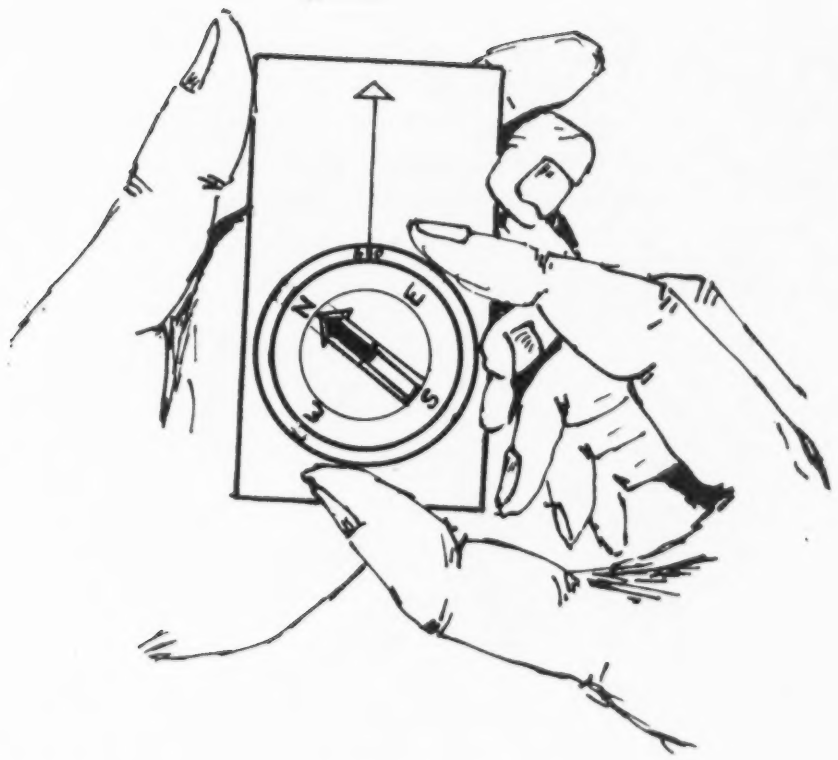
3. Turn your whole body including your feet slowly until the red magnetic needle is pointing North on the compass housing; at this time it will be superimposed on the black orienting arrow.

4. The direction of travel arrow will be facing the desired azimuth -- in this case 60 degrees.

5. To follow this azimuth select a landmark directly in line with the direction you are now facing. Looking at this landmark (tree, bush, hill) you may walk directly towards it, using it as your guide without having to refer to the compass.

DETERMINING THE BEARING FOR A LANDMARK

1. Select a landmark to which you want to go. Face the landmark with the direction of travel arrow in the compass pointing toward it. Be sure to keep the arrow perpendicular to the body.



2. Turn the compass housing until the red end of the magnetic needle lies directly over the orienting arrow.

3. The bearing of the landmark you selected is read where the direction of travel arrow meets the compass housing. In this case it is 60°.

Concept: a. Accurate map construction is dependent upon both scale and direction.

b. A protractor is an instrument used to measure and mark off angles.

Lead-up Activities:

1. Review the concept of map scale.
2. Review the use of the compass to find direction.
3. Review or present the use of the protractor.
4. Divide the class into pairs or groups of four or five students. The fewer groups you have, the more individualized help you can give in the field. Each student should select one job to be done outside: direction finder (one student); direction recorder (one student); distance finder (one or two students); and distance recorder (one student).

Outdoor Activity: Taking Field Data for Map Making

Materials: Compass
Paper
Pencil

Have the students choose an area in the field to be mapped (see p. M-12).

Follow-up Activities:

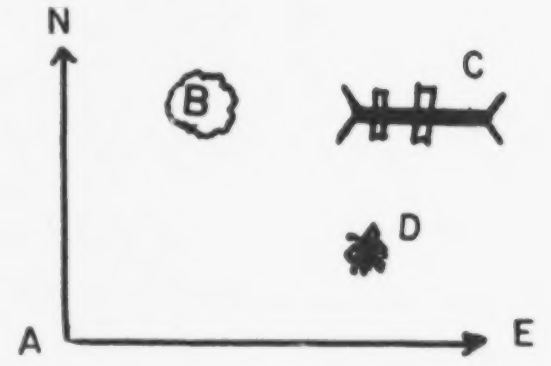
Materials: 8 1/2" x 11" graph paper
Protractor
Drafting Compass
Pencil

1. Have the students use the data collected in the field to construct a map (see p. M-13).
2. If appropriate, the mathematical concept of similar triangles can be related to this activity.
3. Advanced students might take readings on objects located in any direction in the field.

USING COMPASS AND MEASUREMENT FOR OBTAINING FIELD DATA FOR MAP CONSTRUCTION

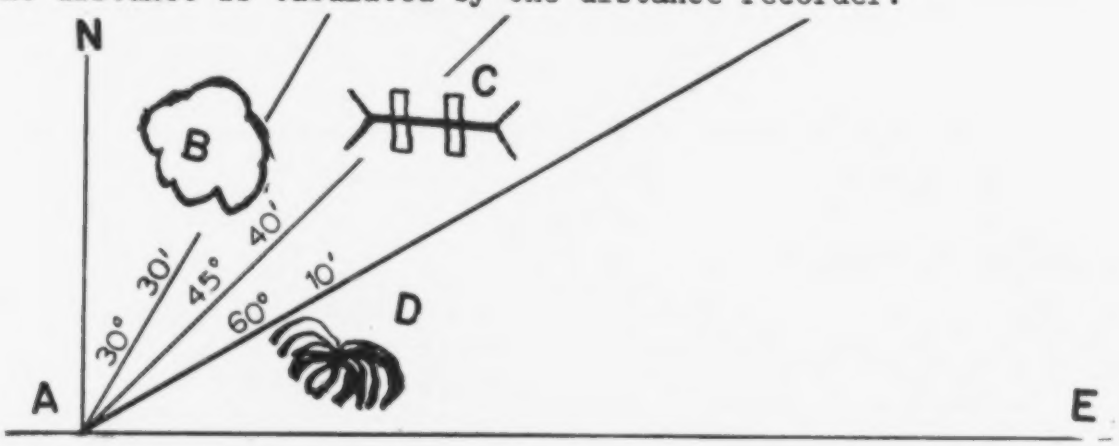
Materials: Compass
Paper
Pencil
Measuring device such as a tape measure or rope.

1. The direction finder* should select a starting point (A) which should be the side of the school or some feature in the field and find 0°, North, and 90°, East, with a magnetic compass. The area to be mapped will lie between these two points.



2. From the starting point, the direction finder should take a compass bearing on a feature to be mapped. The bearing (azimuth) should be recorded by the direction recorder.

3. The distance finder should determine the distance between the starting point and the feature by direct or indirect methods. The distance is tabulated by the distance recorder.



4. The other features (C,D, etc.) in the area can be located by repeating steps 2 and 3. The orginal starting point A is used in each case to determine the azimuth and the distance.

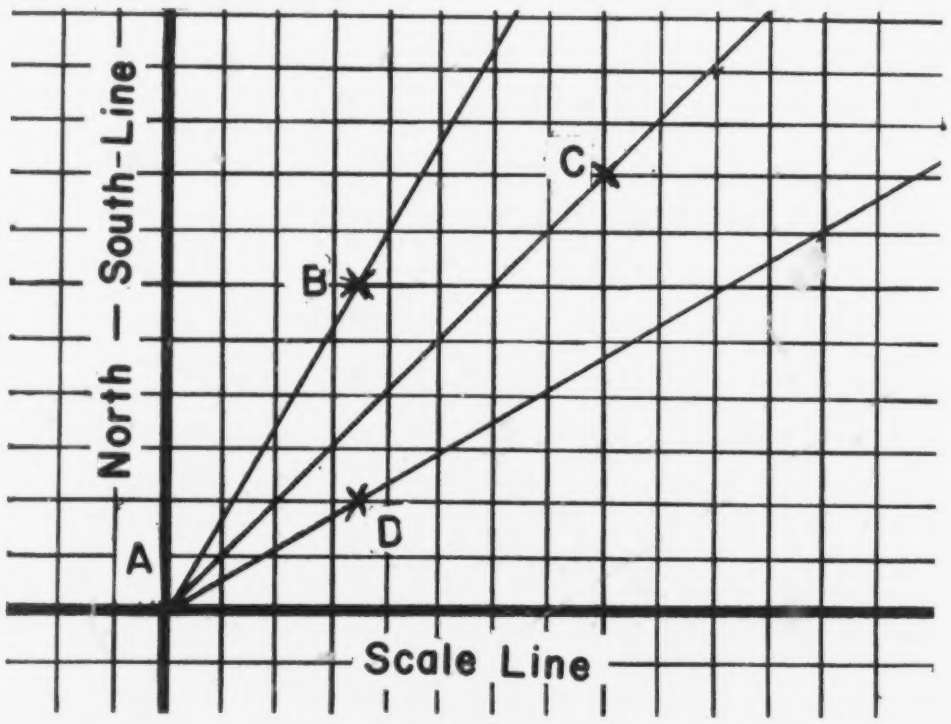
5. An example of a method used to record the field data is shown below.

Feature	Azimuth	Distance
A to B (Tree)	30°	15 steps or 30 feet
A to C (Swing)	45°	20 steps or 40 feet
A to D (Evergreen)	60°	10 steps or 20 feet

*If working in pairs each person will have more than one job to do.

FOLLOW-UP MAKING A MAP WITH A COMPASS

Materials:
- 8 1/2" x 11" graph paper
- Protractor
- Drafting Compass
- Data from the field
- Straight edge



1. Draw a scale line (east - west line) the full width of the paper about one inch from the bottom.

2. Determine a scale that will allow all of the features to fit onto the paper. For example 1 square = 5 steps or 1 square = 5 feet.

3. Draw a north-south line perpendicular to the scale line one inch from the left margin of the paper.

4. Place a dot at the intersection of the north-south line with the scale line. This represents A and zero on the scale line.

5. Place the protractor over the north-south line with the center at 0 and mark 30° (the azimuth reading of object B).

6. Draw a light from A at an angle of 30°.

7. Set the width of the compass by the scale the distance B is than A and draw an arc. The intersection of the arc and the line drawn at 30° is the location of B on the map.

8. Repeat steps 5, 6 and 7 to determine the location of each of the other features on the map.

9. Erase the lines in 6. Symbols can be used for each feature.

Concept: Simple maps may be constructed by using rays and line segments.

Lead-up Activities:

1. Have the students use the library to find out what type of instruments were used by the early surveyors.
2. Review the procedure for determining the scale for maps.
3. Determine the length of each student's step or pace, if the distances between features are to be estimated.
4. Have the students help in the construction of an alidade. An alidade can be made by using two 1" finishing nails and a wooden one foot rule. Place one nail at each end of the rule at an equal distance from the drawing edge.
5. Discuss with the class the function of line segments and rays.
6. Divide the class into small groups for working in the field.

Outdoor Activity: Map Making using rays and line segments with simple instruments.

Materials:
- Drawing paper 11" x 14"
- Masking tape
- Pencil
- Alidade
- Compass
- Plane Table (a cardboard box 3' x 3' x 4' may be used)
- Measuring Tape

Have the students place the plane table in the center of the area to be mapped and locate each of the objects with the alidade. (see p. M-15).

Follow-up Activities:

1. The students should determine a scale to be used and record the scale on the map.
2. They should then mark the scale distance for each of the objects on the appropriate lines sighted to the objects in the field.
3. Symbols can be used to locate each object on the map.
4. Compare the maps made by the different groups of students.
5. Review the geometric principles involved in map making.
6. Discuss the problems early map makers might have encountered.

COLLECTING DATA FOR

MAP MAKING USING LINE SEGEMENTS AND RAYS WITH SIMPLE INSTRUMENTS

Materials: Drawing paper 11" x 14", masking tape, pencil, alidade, compass, plane table (a cardboard box 3' x 3' x 4'), measuring tape.

1. Have the students select a relatively flat area of the school grounds containing several features to be mapped.

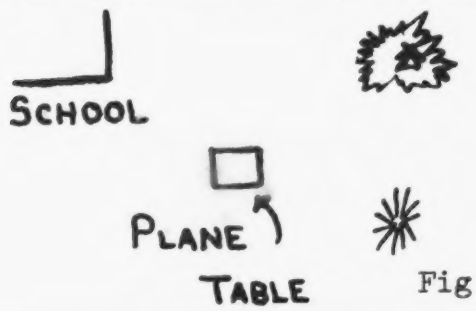


Fig. 1

2. Locate the approximate center of the area; set up the plane table and secure the center of the drawing paper on it with masking tape. (figure 1)

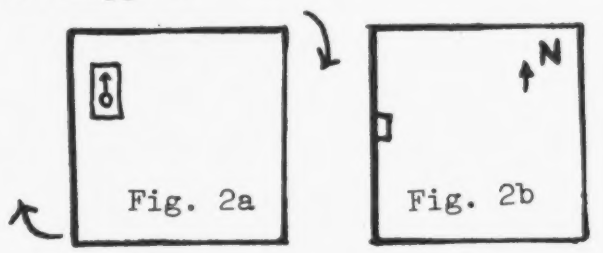


Fig. 2a Fig. 2b

3. Place the compass (set at 360°) on the drawing paper along one edge (figure 2a) turn the plane table until the magnetic needle lies in the same direction and directly over the orienting arrow (figure 2b). The paper is now lined up in the north-south direction.

4. Draw a 3" north-south line in the upper right hand corner of the drawing paper. (figure 2b). (The table SHOULD NOT BE MOVED during the duration of the mapping exercise).

5. Place a dot in the center of the drawing paper to mark the relative position of the paper in the field. Place one corner of the alidade at the dot and rotate it around until the first feature is sighted. The line of sight should connect the two nails on the alidade and the feature in the field (figure 3).

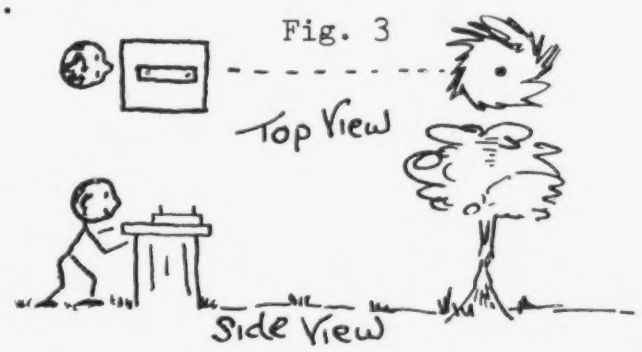


Fig. 3

6. Draw a line along the edge of the alidade and label the line with the name of the feature sighted.

7. Measure the distance from the plane table to the feature sighted, by direct or indirect methods and record the distance on the line.

8. Steps 5,6 and 7 should be repeated until all the features to be mapped have been sighted and the distance recorded.

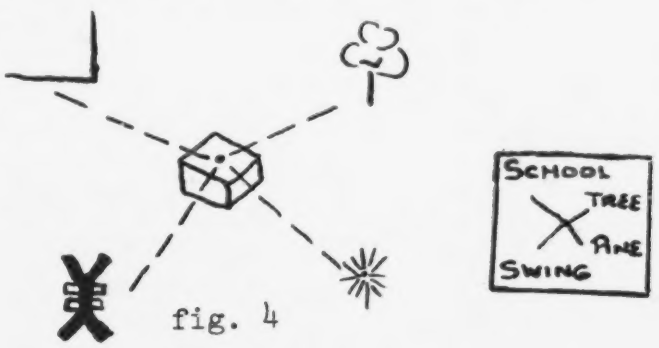


fig. 4

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FOR
MAP AND COMPASS

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UNIT ON SOILS

Introduction:

"Soil is a basic necessity of life. From the soil comes most of the materials that feed, clothe and shelter us. From the soil springs the vegetation that adds beauty to the landscape." [1]

A child has a close relationship to the soil. He makes mud pies, digs tunnels and in general, gets dirty. But does a child really understand soil and how necessary it is to his survival?

General Objective:

To give elementary school children a direct learning experience in soil study.

Specific Objectives:

1. To have students become more aware of the soil formation processes.
2. To illustrate the fact that soil is composed of both organic and inorganic matter.
3. To make students aware that soils are divided into layers or horizons.
4. To have students become aware of how different types of soil have different effects on plants and man.
5. To show the different ways in which man destroys and conserves his soil resource.
6. To become more aware of the dynamic and living features of the soil.

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[1] Pennsylvania Teaching Guide to Natural Resources Conservation, Department of Public Instruction, Curriculum Services No. 7, Harrisburg, Pennsylvania, 1964.

S-2

Concept: Rocks are physically broken down into soil particles through weathering.

Lead-up Activities:

1. Discuss the different agents of weathering such as water, wind and temperature changes.
2. Discuss the effects of weathering on the physical break-down of rocks, including freezing, thawing, and wind.

Outdoor Activities:

1. Have the class look for signs of weathering that are going on around the school building. These might include such things as the cracks in the sidewalk, the smoothness of the brick on the building or the roundness of stones found near the water.
2. Have each student or group of students find two small rocks of soft material such as shale or sandstone. Rub the stones together over a piece of paper catching the pieces that break off. Carefully bring the paper with the pieces back into the classroom.

Follow-up Activities:

1. Discuss the results of rubbing the two stones together and when such action might take place in nature.
2. Heat a small piece of the limestone over a flame or a hot plate. Drop it quickly into a pan of ice water. The rock should break or crack as it contracts after its expansion by heating. This is best done as a demonstration for the class.
3. Have the students plant seeds in the soil they made by rubbing the stones together. After a few weeks the class can discuss what else is needed in soil for plants to grow.

Concept: The decomposition of organic matter helps in soil formation.

Lead-up Activities:

1. Have a discussion about the decomposition of organic material and how it helps to form soil.
2. Discuss processes such as rotting and the action of bacteria and insects on the decomposition of plants.
3. Discuss the stages of decomposition.

Outdoor Activities:

1. Have the students find evidence of organic objects that are starting to decompose.
2. Examine the soil where leaves or pine needles have fallen and have the students look for last year's leaves and the leaves and needles from the years before.
3. Bring in some of the material that has started to decompose.

Follow-up Activities:

1. Have the students examine the soil with a hand lens and try to find some of the decomposing organisms.
2. Discuss the difference between this soil and the soil that the students made from the rocks.
3. Have the students plant seeds in the soil that they brought in.

Concept: The soil is divided into layers or horizons.

Lead-up Activities:

1. Review how soil is formed with the class.
2. Have a discussion about the different layers of soil and the differences that might be found between layers.

Outdoor Activities:

1. Take the class outside and look for areas where one can see the different layers of the soil. Construction sites or the side of an eroded hill are good places to use.
2. Materials: Glue, paper, soil probe or shovel

   Have the class take their own soil profile to bring inside to study (see p. S-5). Make a profile in several different areas.

Follow-up Activities:

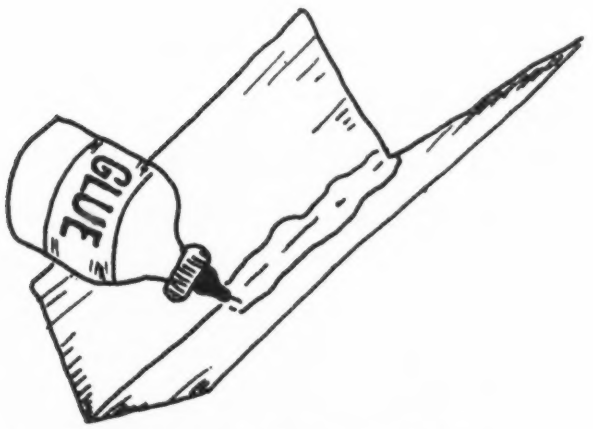
1. The students should look at each profile and determine the differences between the texture of organic matter and the color between horizons.
2. Have a discussion so that the students can see that the corresponding horizons in each area may differ in size. Ask them to determine what might account for these differences.

Soil Profile

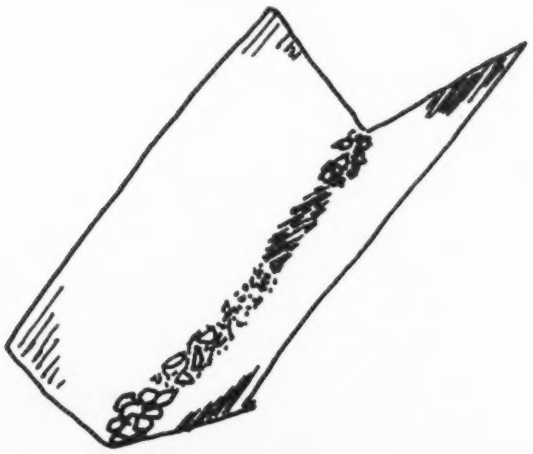
To compare the composition of soil at different levels.

To compare the soil in different areas by studying its composition at different levels.

To make a permanent soil profile.



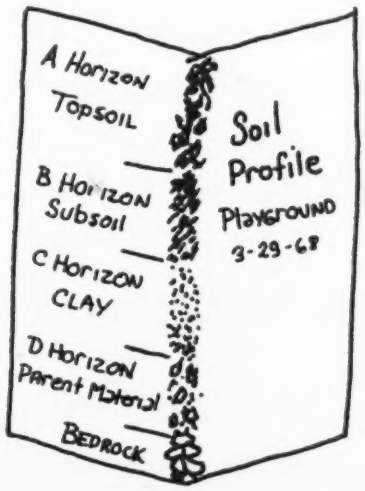
1. Fold a large piece of white tag board in half. Open it and place a 6" band of glue down the middle.



3. Place the soil carefully on the paper in order of digging. Mark the depth on the side.

   Examine the soil for differences in such items as moisture, animal life, color and texture.

2. Take a core of soil using either a soil probe or shovel. Be careful not to destroy the profile.



4. After glue dries gently shake off the excess soil. The soil left on the paper serves as a permanent soil profile.

Concept: Soil permeability depends upon ground cover and soil texture.

Lead-up Activities:

1. The students should be made aware that permeability is related to the amount of moisture that can be absorbed by the soil at one time.
2. Have a discussion about the nature of soil permeability and what factors might effect the perculation rate.
3. Make a chart to compare the permeability rate in different areas. Include such information as the general use of the area, ground cover, type of soil, consistency and rate of perculation.

Outdoor Activity:

Materials: #10 tin can with both ends cut out, mason jar, watch, and a chart to record data.

Take the class outside and have them check the permeability of different areas around the school grounds (see p. S-7). For each area record the time it takes for the water to be absorbed and the other general information on the chart.

Follow-up Activities:

1. Have the students identify what physical characteristics of the soil might account for the differences in perculation rate found in the areas sampled. Factors that might account for these differences include such things as the amount of organic and inorganic matter, composition, consistency, ground cover, and the use of the area.
2. Discuss with the class the advantages of areas where water intake is fast and the disadvantages of an area with a slow perculation rate.

Permeability of Soils

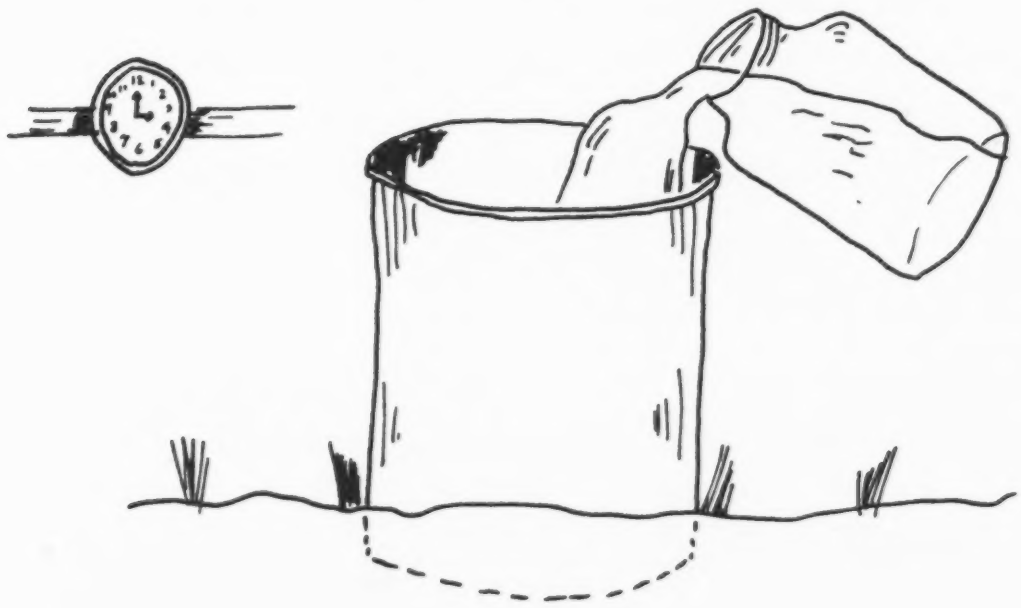
To demonstrate the permeability of different types of soils

Materials: a #10 tin can with both ends cut out, a mason jar, a watch

USE

Sometimes a board placed across the top of the can and pounded with a hammer is needed to place the can in very impacted soil.

a. Push the #10 can into the area of soil to be tested (about one inch or deep enough to make sure no water runs out the edges)
b. Fill the mason jar to the top and pour it into the tin can
c. Time how long it takes the water to run out of the can



Ask the children why it takes longer in one type of soil than another. Why does it take longer on a path than in the middle of a field? What does this tell us about the type of soil in the area?

Have the children repeat the experiment in many areas, always being sure to use the same quantity of water. Have them accurately record their findings.

S-8

Concept: Soil is composed of both organic and inorganic matter.

Lead-up Activities:

1. Review the different methods of soil formation with the class.
2. Have a discussion about the difference between organic and inorganic matter.

Outdoor Activities:

1. Have each of the students select an area and examine the soil to determine the amounts of organic and inorganic matter in it.
2. The students should take soil samples from different areas and keep a record of the type of ground cover for each sample. All samples should be taken from the same depth.

Follow-up Activities:

1. Have the students examine the soil samples and try to determine the amounts of organic and inorganic materials in each. They should note the differences and similarities of each sample.

2. Discuss what factors might account for the differences found in the soil from the different areas. A graph can be used to illustrate the different factors.

Concept: Growing plants and dead leaves protect soil from erosion.

Lead-up Activities:

1. Discuss with the class what soil erosion is and how it differs from soil formation.
2. The process of erosion by nature and how man has caused the problem to increase should be reviewed with the students.
3. Discuss the relationship of slope and ground cover to run-off and erosion rate.

Outdoor Activities:

1. Have the students find as many evidences of erosion around the school yard as possible. Note possible solutions to each situation.
2. After a rain have the students collect water from a nearby stream. Keep the water inside. After a few days collect water from the same stream and compare the samples.

Follow-up Activities:

1. Demonstrate the soil sun-off test and discuss the effects of different types of soil and ground cover used for the test (see pp. S-10, 11, and 12).
2. Discuss how the process of erosion can be constructive in the process of soil formation, but at the same time be destructive to soil which has already been formed.
3. Discuss good practices of soil conservation including the growing of plants on eroded hillsides, contour plowing, planting trees, and the growing of cover crops.
4. The students might locate an erosion problem in their area and look for ways to help solve it. If time allows they should work on the project.

S-10

Soil Run-off Test

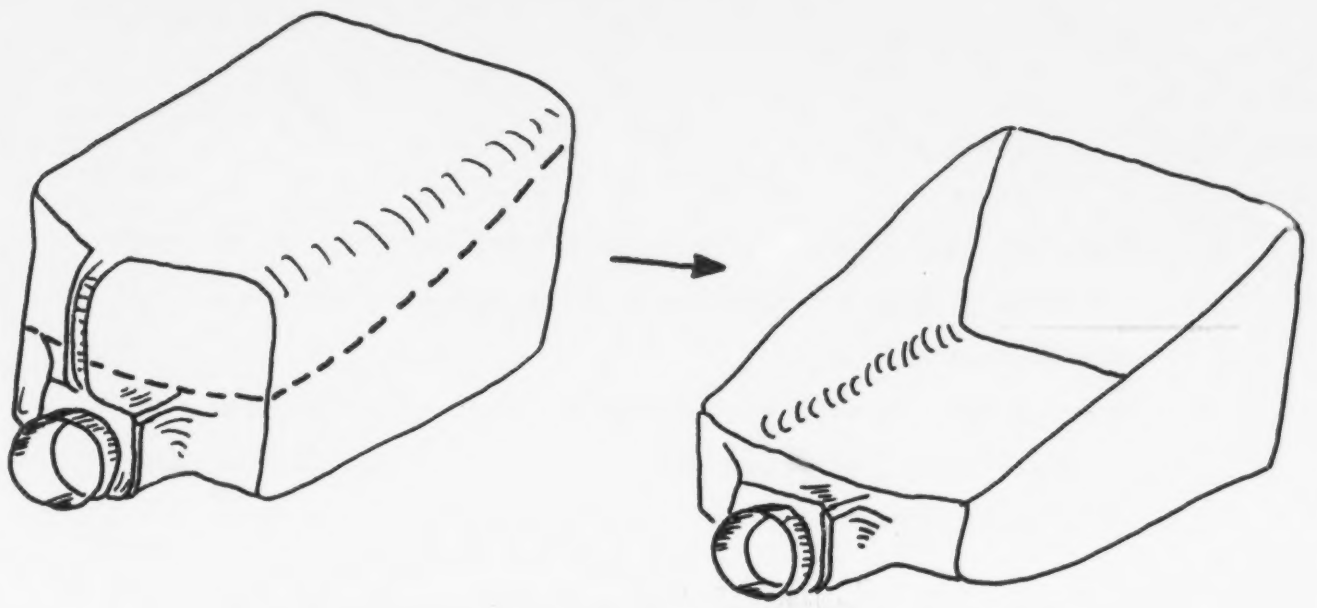
1. A method of demonstrating the water holding characteristics of different types of soil and different types of soil coverage

Materials: 2 one-gallon plastic milk cartons, 4 mason jars, 2 tin cans of equal size , masking tape, 2 pieces of wood

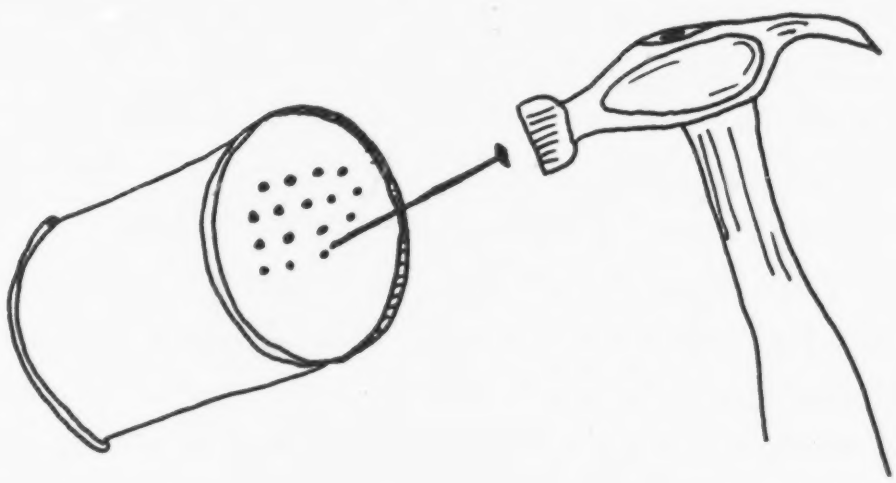
Tools: Scissors, nail, hammer, a shovel

Construction:

1. Cut plastic milk cartons so the back is high and the spout is located towards the bottom



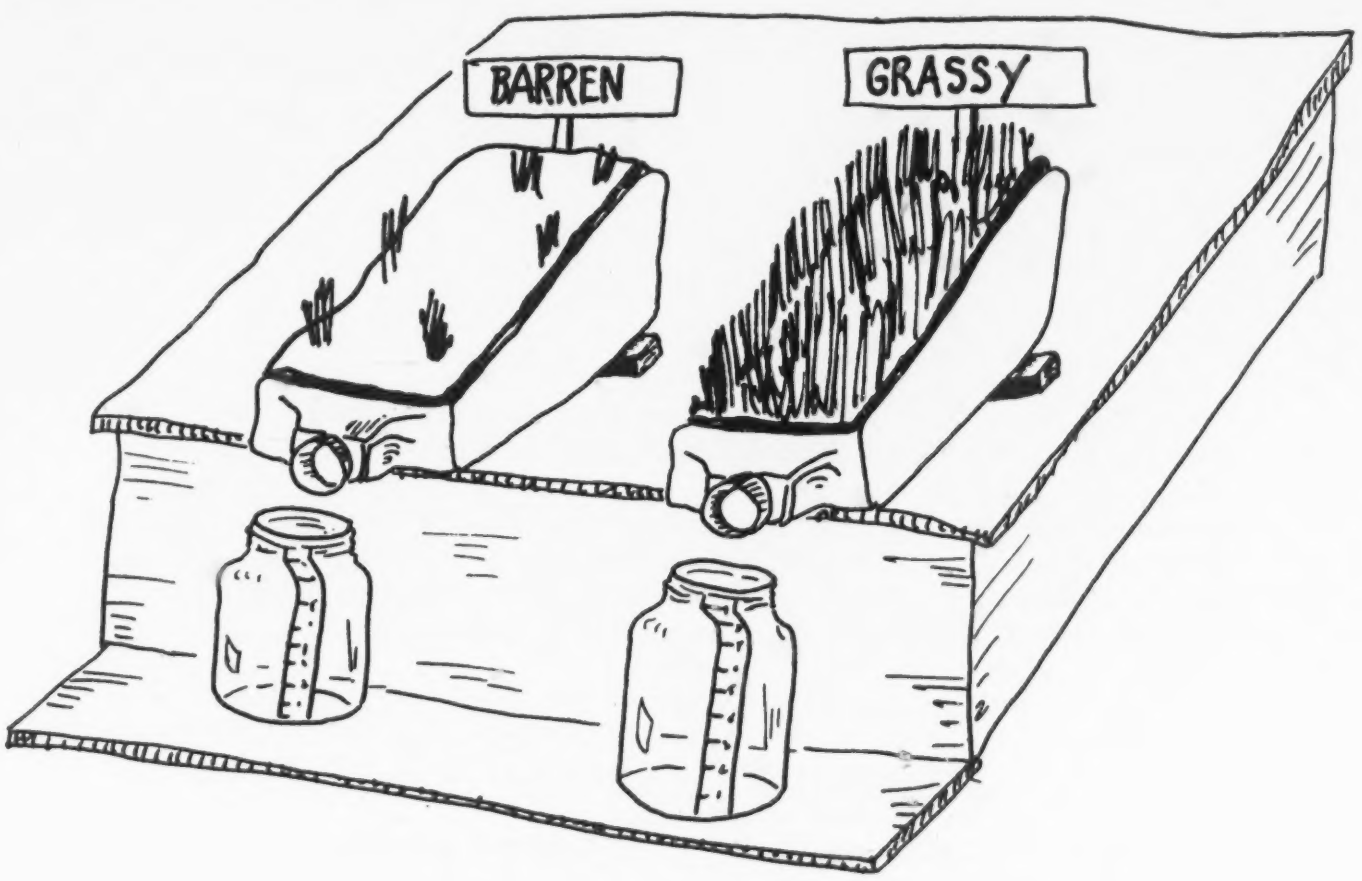
2. Punch holes in the tin cans; place the same number of holes in each can in approximately the same pattern



3. Place tape on the outside of jars and mark off in any number of equal spaces. Do the same for each jar making sure the number of spaces marked off is the same.

USE

Take samples of different types of soil or soil with different types of ground cover and place in plastic milk cartons. Raise the back part of the milk cartons with a small piece of wood.



Place mason jars under each of the milk cartons. To cause rain to fall on the plots, hold tin cans over the soil samples and pour equal amounts of water into each can from the mason jars. Wait a few minutes.

Now compare the amount of run off in the two collecting jars. Which has the most? Why is there more dirt in one than the other? Why is there less water in one than the other?

Now examine the effect on the "rain" on the soil samples. What evidences are there of erosion?

Try many different soil samples and many ground cover types. Allow the children to conduct the experiments and to draw conclusions. Make sure that they record carefully all of their findings. Then ask the children what general conclusions they can make.

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